of illustrating the ordinary text-books in the hands of students. Many interesting specimens have been given by Sir Joseph Hooker and Mr. Thiselton Dyer, Messrs. Potter, Vines, Gardiner, Hillhouse, and Miss B. K. Taylor of Girton College.

In the Museums of Zoology and Comparative Anatomy some most useful work has been done by the Strickland Curator (Mr. Gadow) in exhibiting the characteristic parts of birds, labelled and illustrated by printed descriptions. A lecture-room for animal morphology is urgently required. The attendances in the Lent Term this year were:—Elementary Biology, 163; Elementary Morphology, 94; Advanced Morphology, 16; total 273. Besides the two lecturers, nine graduates and advanced students took part in demonstrating to the classes. Prof. Macalister reports that the new iron dissecting-room has been very satisfactory, and far more anatomical work has been done than ever before in the University.

The number of students in the elementary physiology classes have averaged 130 each term; while an average of over 30 attended advanced lectures. In pathology Prof. Roy has given systematic lectures on general pathology, a demonstration course on morbid anatomy, a practical pathology course, morbid histology classes, &c., and has found it necessary to engage Mr. Joseph Griffiths, M.B. Edin., as his assistant. Space and other accommodation being deficient hampers the extension of the work.

Vigorous work in natural science will go on during July and August. Mr. Fenton will give a course of chemistry, and the University and Cavendish Laboratories will be open. Mr. Potter will lecture on systematic botany with practical work. Repetition classes in histology and physiology will be given by a demonstrator, and Dr. Hill will conduct a class for practical histology. Prof. Macalister will give demonstrations in osteology; and other lectures will be given regularly in connection with the medical school by Prof. Humphry, Prof. Roy, Dr. Anningson, Dr. Ingle, &c. The courses will begin from July 7 to 12.

Mr. W. H. Caldwell, Fellow of Caius College, and Balfour Student, having returned to Cambridge from Australia with a large supply of valuable material, asks for a room in which to prosecute his original researches. This it is proposed to supply at a cost of 110*l.* on the roof of a portion of the Museum Buildings.

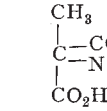
SCIENTIFIC SERIALS

American Journal of Science, May.—The columnar structure in the igneous rocks on Orange Mountain, New Jersey, by Joseph P. Iddings. This paper, read before the Philosophical Society of Washington, June 1885, deals especially with the large vertical columnar formations of O'Rourke's Quarry south of Llewellyn Park, and with the still more interesting case of curving and radiating columns in the Undercliff Quarry near the north gate of the same park. These lava sheets are studied in connection with the general theory of columnar formation, which is attributed to a cracking produced by the shrinkage of the mass upon further cooling after it has consolidated into rock, which still retains a great amount of heat. As the consolidation due to surface-cooling proceeds inward, the resistance to contraction parallel to the surface increases at a greater rate than that normal to it, a point may then be reached where resistance in the first-named direction will exceed that in the second, and the resulting rupture will be *perpendicular* to the cooling surface. The wavy form of some of the columns in Orange Mountain suggests irregularities in the mass which disturbed the uniform advance of the lines of maximum strain, and caused them to deviate from parallelism.—Larval theory of the origin of tissue, by A. Hyatt. This is an abstract of a paper published in the *Proceedings* of the Boston Society of Natural History (1884), in which an attempt is made to trace a phyletic connection between Protozoa and Metazoa, and also to show that the tissue-cells of the latter are similar to asexual larvæ and related by their modes of development to Protozoa, just as larval forms among the Metazoa themselves are related to the ancestral adults of the different groups to which they belong. In the abstract the suggestion is added that Volvox and Eudorina are true intermediate forms entitled to be called Mesozoa or Blastrea. The author's conclusions bear directly on the results already obtained by Semper, Dohrn, and others in tracing the origin of the vertebrates to some worm-like type.—Cretaceous metamorphic rocks of California, by George F. Becker. During a recent investigation of the Californian quicksilver deposits by the United States Geological Survey, the crystalline and serpentinoid metamorphic rocks of the coast-ranges have been subjected to an elaborate examination. Pending a complete report, a summary of the results is given in the present paper, all detailed proofs being deferred until final publication. The field-work was carried out by the author and Mr. H. W. Turner, the chemical analyses by Dr. W. H. Melville; and the microscopical examinations jointly by the author and Mr. Waldemar Lindgren. The question of metamorphism has perhaps never before been studied under more favourable conditions: a solid basis has been obtained for further inquiry, while the results already secured are sufficiently definite to form an important aid for the investigation of metamorphic areas in other geological regions. One important result is the full confirmation of von Rath and Bischof's views regarding the probable conversion of feldspar into serpentine. There seems to be no doubt that the phenomenon occurs in the Californian coast-ranges where the feldspars are corroded externally, cracks widened irregularly and filled with serpentine, and in some cases elongated teeth of serpentine may be seen biting into the clear feldspathic mass. It is impossible to explain these and many similar occurrences, except on the supposition that a reaction between some fluid and the feldspars has yielded serpentine. Quartz also, which is well known to be sometimes converted into talc, is in the same region transformed into serpentine.—Arnold Guyot, by James D. Dana. This is a biographical sketch of the distinguished Swiss naturalist, brought down to the year 1848, when he settled in the United States.—On the determination of fossil dicotyledonous leaves, by Lester F. Ward. The writer offers some critical remarks on the views, and especially on the system of nomenclature, advocated by Dr. A. G. Nathorst of Stockholm in a paper on fossil floras recently published by him in the *Botanisches Centralblatt* (xxvi., 1886).—Pseudomorphs of limonite after pyrite, by Erastus G. Smith. It is shown that the common hydrated oxides of iron generally referred to limonite are undoubtedly alteration products of ferrous oxide, or decomposition-products of other iron-bearing minerals. Their secondary nature is clearly shown in the various occurrences where crystalline form is yet retained, giving clearly-defined pseudomorphs of ferric hydrate after the original mineral. An interesting case is described of such an alteration of pyrite into ferric hydrate, in which the crystalline form of the pyrite is sharply defined.—Influence of motion of the medium on the velocity of light, by Albert A. Michelson and Edward W. Morley. A series of important investigations are described, tending fully to confirm Fizeau's classical experiment of 1851, which proved that the luminiferous ether is entirely unaffected by the motion of the matter which it permeates.—Note on the structure of tempered steel, by C. Barus and V. Strouhal. The results are given of some experiments on the structure of steel, a full report on which will appear in *Bulletin* No. 35 of the U.S. Geological Survey.—Brookite from Magnet Cove, Arkansas, by Samuel L. Penfield. A description is given of a fine crystal of brookite from the collection of Prof. G. J. Brush. It belongs to the variety classed as arkansite by C. A. Shephard.

Bulletin de l'Académie Royale de Belgique, March 6.—Determination of the direction and velocity of the motion of the solar system through space, by M. P. Ubaghs. So far from being a constant quantity, the systematic aberration of the sun and its satellites was already shown to vary with time in right ascension and declination. It was also seen that, by taking into account this fact in studying the motion of the solar system, it might be possible to determine not only the direction and velocity of the motion, but also its extent and even the mean distance of the stars selected for the purpose of comparison. The author here undertakes to apply the principle to certain groups of stars of like magnitude, and although the results are not absolutely uniform, the agreement is sufficiently close to justify the conclusion that theory and practice are, on the whole, in harmony. The direction of the motion has been somewhat accurately determined, but the mean velocity expressed by the fraction 0·109 of the mean radius of the earth's orbit would appear to be far less than that usually attributed by astronomers to the motion of the solar system.—On the study of "arithmetical events," by M. E. Cesàro. In explanation of the expression "arithmetical events," this young and profoundly original mathematician remarks that the systems with which he is here occupied are constituted by numbers taken at hap-hazard. When such a system happens to

enjoy a property capable of being stated in advance, it constitutes for him an event (*un événement*). By means of some extremely difficult and subtle analytical transformations he arrives at a very general and remarkable formula, by means of which he solves with the greatest ease a number of curious arithmetical problems, such as: "What probability is there that in any given division the most approximate quotient will be the quotient by default (*par défaut*)? What probability is there that, if an integer taken at hazard be divided by the sum of two other integers taken at hazard, the quotient by default will be an odd number?"—On the oxidation of hydrochloric acid under the influence of light, by M. Leo Backelandt. This paper deals with the phenomenon observed by the author, that concentrated pure hydrochloric acid exposed to the action of sunlight in a badly-stopped flask after some time turns yellow, and emits an odour of chlorine. The change is shown to be due to a process of oxidation, the atmospheric oxygen consuming the hydrogen of the hydrochloric acid and liberating the chlorine. Under analogous circum tances hydriodic acid acts in the same way, liberating its iodine.—Notes on the rocks of Kantavu Island, Fiji Archipelago, by M. A. Renard. The author deals mainly with the andesites of the port of Kantavu, where they assume a columnar disposition.—Examination of the objections made by M. Hirn against the kinetic theory of the gases, by M. R. Clausius. While admitting the general care and accuracy with which M. Hirn has conducted his extensive experiments, the author argues on theoretical grounds that they are in no way opposed to the now generally accepted kinetic theory.

Rendiconti del Reale Istituto Lombardo, April 15.—On the permanent magnetism of steel at various temperatures, by Dr. G. Poloni. In this paper, which is supplementary to the two memoirs published by the author in 1878 and 1882, several interesting experiments are described with a series of magnets subjected to the action of heat within the limits of 15° and 300° C.—Note on a new acid isomerous with aspartic acid, by Prof. G. Körner. The formula of this acid, which the author proposes to name α-iso-aspartic or α-amido-isosuccinic acid, is—



Rivista Scientifico-Industriale, April 15.—A new method of measuring the thermic expansion of solid bodies, by Prof. Filippo Artimini. The author describes an ingenious apparatus which he has constructed for the purpose of determining with sufficient accuracy the increase in the linear dimensions of solids, derived from the internal motion communicated to matter by thermic energy.

April 30-May 15.—On the real atomic heat of simple bodies in the mechanical theory of heat and the formulas relating to it, by Prof. Alessandro Sandrucci. In Hirn's "Mechanical Theory of Heat" the expression *real atomic heat* is applied to the product of the atomic weight a of a simple body by its absolute calorific capacity K, and it is shown that this quantity should be independent of temperature, and equal and constant for all existing simple bodies; but the deductions are established independently of any hypothesis on the nature of heat. Prof. Sandrucci now inquires whether, given a certain hypothesis on the nature of heat, and determining the physical concept of *real atomic heat* in said hypothesis, it might be possible to obtain general and numerical results equal, or very nearly equal, to those already found by Hirn.—On a new saponiferous plant, by Prof. G. Licopoli. To the *Saponaria officinalis*, the *Quillaja Saponaria*, and a few other plants of this class Prof. Licopoli now adds the *Enterolobium Timbouva*, Martius, which is widely diffused throughout South Brazil and Uruguay.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 20.—"On the Lifting Power of Electro-Magnets and the Magnetisation of Iron." By Shelford Bidwell, M.A.

If an electro-magnet be excited by a gradually increasing current, a limit is soon reached beyond which the ratio of increase of sustaining power to increase of current becomes rapidly smaller; and it has generally been assumed that this ratio continues to diminish indefinitely, so that an infinite current would not impart to a magnet much greater lifting power than that which it possesses when an approach to "saturation" is first indicated. Joule estimated that the attraction would never be as much as 200 lbs. per square inch of sectional area; and, much later, Rowland assigned 177 lbs. per square inch, or 12,420 grms. per square centimetre as the limit for iron of good quality.

Having reason to doubt these conclusions, the author made some experiments with an iron ring cut into two equal parts, each of which was surrounded by a coil containing nearly 1000 turns of insulated wire. When one-half of the ring was used as an electro-magnet, and the other half as an armature (no current being passed through its coil), the weight supported was with a current of 4·3 amperes 13,100 grms., and with 6·2 amperes 14,200 grms., per square centimetre of surface. The lifting power therefore exceeded that which had been previously considered the greatest possible; nor was there any indication that a limit was being approached. But it was of greater interest to observe the effects produced when *both* portions of the ring were brought under the influence of gradually increasing currents, the conditions then being nearly the same as in Rowland's experiments. It was found that when the magnetic force had reached 50 C.G.S. units, at which point the weight sustained was about 10,000 grms. per square centimetre, the falling off in the rate of increase of the lifting power was well marked. And it continued to diminish until the magnetic force was 250 units and the weight supported 14,000 grms. But from this point *the magnetising current and the weight that could be carried increased in exactly the same proportion*, and continued to do so until the magnetic force had been carried up to 585 units, when the experiment was stopped, the maximum weight supported having been 15,905 grms. per square centimetre, or 229·3 lbs. per square inch. Detailed results are given in the first and second columns of the table. A curve plotted with the magnetic forces as abscissæ, and the weights lifted as ordinates, becomes, when the magnetic force is greater than 240 units, a sensibly straight line inclined to the horizontal axis.

It occurred to the author that these results might be applied to the investigation of the changes of magnetisation which correspond to changes of magnetic force. For if W = the grms. weight supported per square centimetre, H = the magnetic force, and I = the magnetisation, then for the divided ring

$$Wg = 2\pi I^2 + HI;$$

and by giving to W and H the values found to correspond, it becomes possible to find corresponding values of H and I. These are contained in the first and third columns of the table. When H has exceeded about 200, the ratio of I to H no longer continues to diminish, and the curve expressing the relation between them apparently becomes a straight line. Were the experiment carried much further, a tendency to a limit would probably be indicated; but if there is one it must be considerably higher than it is generally believed to be.

If k denote the susceptibility, μ the permeability, and B the magnetic induction, then $I = kH$, $\mu = 1 + 4\pi k$, and $B = \mu H$. Hence the values of k, μ, and B corresponding to different values of H can be found, and are given in the table. The figures in the last two columns are of great interest. Rowland, in order to exhibit the results of his well-known experiments in the form of a curve which (as he believed) would be of finite dimensions, plotted the values of μ as ordinates against those of B as abscissæ. The curve of μ thus obtained, after reaching a maximum for B = 5000, fell rapidly and in an almost straight line towards the horizontal axis. Assuming that the line would continue to be straight until it actually met the axis, Rowland concluded that the maximum of magnetic induction was about 17,500 units.

Now the greatest magnetic force used in Rowland's experiments was only 64 C.G.S. units; the imaginary part of his curve, therefore, corresponds to values of H ranging from 64 to infinity. A part of this exceedingly wide gap is filled by the author's experiments, in which H reaches 585; and if the values of μ and B given in the table are plotted, the curve will be found (after a rapid descent) to *bend round* soon after the limit of Rowland's observations, ultimately becoming, when B = 19,800, almost parallel to the axis of B.